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SIR EDWARD SABINE.

Sir Edward Sabine was born in Dublin, October 14, 1788. He died, June 26, 1883, at the great age of nearly ninety-five years. His grandfather and his uncle had served with distinction in the army, and he received his own education at the military colleges of Marlow and Woolwich. The exigencies of the service were urgent: so that he obtained his first commission in December, 1803, at the early age of fifteen. He was employed for a year at Woolwich, and then sent to Gibralter, where he remained until 1807. On his return, he was assigned to the Horse-Artillery, and ordered to various home stations until the war came with the United States, in 1813–14. In January, 1813, he was attached to a company in Canada. The ship in which he embarked was captured by a privateer, which was in its turn recaptured by a British frigate, and he reached Halifax in safety. Captain Sabine served with credit at Quebec, on the Niagara frontier, and at the attack on Fort Erie, and received honorable notice in the despatches of the commanding officer. The remainder of his military service was limited to the nine years following 1830, when the troubled condition of Ireland required his presence with his company or upon the staff. Though he reached the rank of Lieutenant-Colonel in 1841, and of General in 1874, the periods of his active professional life were only brief episodes in a career eminently scientific. "Peace hath her victories no less renowned than war": and the government early recognized in him the qualities and tastes which admirably adapted him to these peaceful conquests.

Captain Sabine was elected a member of the Royal Society of London, April 16, 1818. By the advice of the Council of this society, he was selected by the Admiralty to accompany the expedition of Commander John Ross, in 1818, in search of a Northwest Passage. His duty was to assist "in making such observations as may tend to the improvement of geography and navigation, and the advancement of science in general." On his return he published a description of twenty-eight species of birds collected in Greenland, and an account of the Esquimaux who inhabit its western coast. In 1821 the Copley Medal of the Royal Society was awarded to him for his scientific services, in which were included his measurements of the force of gravity by the vibrations of a pendulum, published in that year. In 1819, he was chosen to go with Lieutenant-Commander Parry on a second Polar Expedition. Parry has recorded his obligations to Sabine "for his valuable advice and assistance during the whole course of this voyage, to the credit of which his individual labors have so essentially contributed." The intensity of the magnetic force of the earth, the dip and declination of the magnetic needle, and the irregularities in its action produced by the iron in the ship, especially in latitudes where the directive force of the earth is feeble, were conspicuous among the subjects which interested Sabine and were discussed in his earlier publications.

The exact figure of the earth may be studied in three ways: 1. by inequalities in the moon's motion; 2. by measuring the lengths of a degree of the meridian in different latitudes; and 3. by the comparative values of the force of gravity in various places, as indicated by the pendulum. In the years 1821–23, Sabine, adopting the last method, vibrated his pendulum at numerous places between the equator and Spitzbergen, and the results of his experiments, spread over eighty degrees of latitude, were published, in 1825, in a thick quarto volume, by the Board of Longitude. For this laborious and able investigation Sabine received the Lalande Gold Medal from the Institut de France. Biot and Babbage have criticised this work; but the numerical value which Sabine assigned to the ellipticity of the earth is substantially sustained by all the experiments with the pendulum to the present time. In 1825 Captain Sabine and Sir John Herschel were appointed Commissioners to coöperate with a French Commission in order to ascertain the difference of longitude between the observatories of Greenwich and Paris, by means of optical signals. The value then obtained differs by only six tenths of a second of time from that now given by electric signals. In 1828, Sabine, Young, and Faraday were appointed "scientific advisers of the Admiralty."

The last forty-six years of Sabine's scientific activity were dedicated to the study of terrestrial magnetism. In 1834–37, he made, in conjunction with Rev. Humphrey Lloyd, or Captain J. C. Ross, a systematic magnetic survey of Ireland, Scotland, and England. The observations, the reductions, and the reports on the subject, published, with maps, by the British Association, were to a large extent his own work. In 1858–61, at the request of the British Association, he repeated the survey, with the assistance of Dr. Lloyd; and with the aid of Captain Evans calculated and reported the values of the dip, declination, and intensity. In his first Arctic voyage, Sabine had noticed with surprise that the magnetic intensity was diminishing in Baffin's Bay while he was moving northward. Hence he suspected that the pole of magnetic intensity was south of his position: a suspicion which was justified by observations made in New York in 1822, where the intensity is greater than at Melville Island in the latitude of 74° N. In his earlier report of 1837 he placed the pole of intensity in the latitude of 52°, which is eighteen degrees south of the pole of dip. This result was deduced from a magnetic reconnoissance at long range. But it harmonizes with the theory of Gauss, and does not conflict with the observations of Captain (now General Sir) J. H. Lefroy, who laid closer siege to it in 1843.

In 1836, an appeal was made by Humboldt to the British government to establish at various places in its vast empire magnetical observatories similar to those then operating in Germany and Russia. Accordingly, in 1839–40, four of these observatories were instituted; viz. at Toronto, St. Helena, the Cape of Good Hope, and Hobarton. They were not intended to be permanent; and the period of their activity varied from three to ten years. Their work was reinforced by the Naval Scientific Expedition to the Antarctic Zone of Sir J. C. Ross and Lieutenant Moore. The observers were selected largely from the younger officers of the Horse-Artillery, and were instructed in their new work by Professor Lloyd at Dublin. It is sufficient to say that most of them acquired a scientific taste and reputation which introduced them to the Royal Society, while they have also risen to the highest rank in their profession. The appointment of Major Sabine as the general superintendent of this great scientific work was fortunate. He devoted twenty years of his life to the arrangement, discussion, and publication of the formidable mass of meteorological and magnetical observations which issued from these prolific observatories. Only a brave heart would have confronted this stupendous task, even with the liberal clerical aid furnished by the government. In the voluminous introductions to the twelve thick quarto volumes which issued from his office, Sabine investigated the periodical changes in the meteorological and magnetic elements, their secular variations, their irregular fluctuations, their relations to solar and lunar time, to disturbances in the sun, and to the aurora. The decennial period in the *amplitude* of the diurnal oscillation of the needle, which Lamont detected in his observations at Munich, reappeared in Sabine's materials, and was extended to the irregular disturbances, and later, by himself and others, to changes in the declination, dip, and intensity. Hansteen, from a larger series of observations, changes the period to eleven years. Meanwhile, Wolf had deduced from Schwabe's catalogue of solar spots a similar period in their number and magnitude About 1852 came the interesting announcement by Sabine, Wolf, Secchi, and Gautier, of a probable coincidence in the maxima of spotfrequency and magnetic disturbance; Wolf not limiting the comparison to recent observations, though the earlier ones on both classes of phenomena are fragmentary.

In addition to his official work, Sabine continued his publication of a series of papers, which he began in 1840, under the title of "Contributions to a View of the Distribution of Magnetism over the Earth." The fifteenth contribution appeared as late as 1876, when its author was eighty-eight years old. In these contributions Sabine collected, arranged, and discussed an immense fund of observations, made by sea or land, in every latitude and longitude, printed or in manuscript, and drawn from innumerable sources, foreign and domestic, many of them inaccessible to the ordinary student. The observations were illustrated by maps, prepared in the office of the Admiralty, under the direction of Captain Evans of the Royal Navy. The astronomer Halley had attempted, with equal boldness, but with inadequate materials gathered in his own voyages, to make a rough sketch of the features of the earth's magnetism in 1701.

Allusion has been made in this notice to only the most important of the one hundred and three papers printed by Sabine. His mind and his pen were incessantly at work. Every subject connected with the physics of the globe interested and occupied him: the temperature of the depths of the ocean, the direction and force of its currents, and their influence on navigation; the influence of the Gulf Stream on the coasts of Europe and on the oceanic horizon; the barometrical measurement of mountains and their effect upon the plumb-line; the length of degrees of the meridian; the meteorology of Bombay; the winter storms of the United States; and the causes of mild winters. At the same time, he was not unmindful of the improvements going on, at home and abroad, in his own arm of the military service. Not less valuable were his services as the scientific adviser of his wife, the gifted translator of Humboldt's "Cosmos and Aspects of Nature," and of Dove's "Distribution of Heat over the Surface of the Earth." The societies which honored him with their highest offices brought him labor as well as distinction, and demanded of him the preparation of many addresses. He was the General Secretary of the British Association from 1839 to 1858, and its President in 1853. In 1846 he was made Foreign Secretary of the Royal Society, in 1850 its Vice-President and Treasurer, and its President between 1861 and 1871. The Royal Medal, then recently re-established by Queen Victoria, was awarded to him in 1849 for his contributions to the study of terrestrial magnetism; and the government created him a K. C. B. in 1869 for his great services in the cause of science. Learned Academies abroad placed his name upon their distinguished rolls, and Universities at home crowned him with their highest honors. He was elected a Foreign Honorary Member of this Academy, May 28, 1867. His life was protracted for a few years after his physical strength was exhausted and his mind had been overshadowed by disastrous eclipse.

JOHANN FRIEDRICH JULIUS SCHMIDT.

Johann Friedrich Julius Schmidt was born at Eutin, in the Grand Duchy of Oldenburg, October 25, 1825, and was educated at the Hamburg Gymnasium. He developed very early in life a taste for the observation of natural phenomena, which was directed into astronomical channels, at the age of fourteen years, by his coming into possession of a copy of Schröter's work on the Moon, which so struck his attention that he at once began his first attempts at astronomical observation by sketching the lunar surface with a small telescope constructed by his father, which he steadied against a lamp-post. This work soon became his chief occupation ; but was carried on with improved facilities, first by a telescope lent him by a gentleman interested in the progress of the young astronomer, and afterwards by the use of the instruments at the Altona and Hamburg observatories, to which latter place he went as an assistant to Rümker in 1842. In 1845 Schmidt went to Bilk, near Dusseldorf, where Benzenberg had established an observatory for the observation of meteors and the search for intra-Mercurial planets. His instrumental facilities here, however, were much restricted, the solicitude of Benzenberg lest the polish and lacquer of the principal telescope should suffer by handling practically prohibiting its use. Benzenberg died in 1846, and Schmidt went to Bonn as assistant to Argelander. Here his lunar work was somewhat interrupted, his time being largely occupied with observations of planets and comets, and with the meridian circle. He made, on the occasion of the total eclipse of the sun, July 28, 1851, important observations, in East Prussia, with reference to the phenomena which are now identified with the chromosphere, revealed more distinctly since that time by the spectroscope.

Later, Schmidt was appointed, on Argelander's recommendation, to the charge of a private observatory established at Olmütz by Baron von Unkrechtberg, provided with a small meridian circle and a five-inch refractor, with smaller telescopes and subsidiary apparatus. He began work here in June, 1853, and actively prose-